**IN THE CLAIMS:**

Kindly amend claims 1-21, cancel claims 22-23 without prejudice or admission, and add new claims 24-37 as shown in the following listing of claims, which replaces all previous versions and listings of claims.

1. (currently amended) A quartz crystal resonator ~~being a flexural mode, quartz crystal tuning fork resonator, said~~ capable of vibrating in a flexural mode of an inverse phase, the quartz crystal ~~tuning fork~~ resonator comprising: a quartz crystal tuning fork base; first and second quartz crystal tuning fork tines connected to the quartz crystal tuning fork base, each of the first and second quartz crystal tuning fork tines having a first main surface and a second main surface opposite the first main surface and a groove having a plurality of stepped portions formed in at least one of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; and an electrode disposed in the groove formed in at least one of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a merit value $M_1$ of a fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than a merit value $M_2$ of a second overtone mode of vibration thereof, the merit values $M_1$ and $M_2$ being defined by the ratios $Q_1/r_1$ and $Q_2/r_2$, respectively,

where $Q_1$ and $Q_2$ represent a quality factor of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator and $r_1$ and $r_2$ represent a capacitance ratio of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator; wherein a piezoelectric constant $e_{12}$ of the quartz crystal tuning fork resonator is within a range of 0.095 $C/m^2$ to 0.19 $C/m^2$ in the absolute value.

~~tuning fork tines; and~~

~~a quartz crystal tuning fork base, to which said tuning fork tines are attached,~~

~~wherein a groove is provided on at least one of an obverse face and a reverse face of said tuning fork tines, and a first electrode is disposed inside said groove and a second electrode is disposed on both sides of said tuning fork tines,~~

~~and wherein a piezoelectric constant~~ $\cancel{e_{12}}$ ~~of said resonator is within a range of 0.095~~ $\cancel{C/m^2}$ ~~to 0.19~~ $\cancel{C/m^2}$ ~~in the absolute value.~~

2. (currently amended) ~~The~~ A quartz crystal resonator according to ~~claim 1, wherein figure of merit~~ $\cancel{M_1}$ ~~for a fundamental mode vibration of said resonator is larger than figure of merit~~ $\cancel{M_2}$ ~~for a second overtone mode vibration thereof, and the~~ $\cancel{M_1}$ ~~is larger than 65 and the~~ $\cancel{M_2}$ ~~is less than 30.~~ claim 1; wherein a groove having a plurality of stepped

portions is formed on each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; and wherein an electrode is disposed in each of the grooves formed on each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a merit value $M_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than 65 and a merit value $M_2$ of the second overtone mode of vibration of the quartz crystal tuning fork resonator is less than 30.

3. (currently amended) ~~The~~ A quartz crystal resonator according to ~~claim 1, wherein a~~ claim 1; wherein the groove formed on at least one of opposite main surfaces of each of the quartz crystal tuning fork tines comprises a through-hole. ~~provided on either the obverse face or the reverse face of said tuning fork tines is a through hole.~~

4. (currently amended) A quartz crystal unit comprising: a ~~flexural mode, quartz~~ quartz crystal tuning fork resonator capable of vibrating in a flexural mode of an inverse phase, the ~~a case; and a lid, said~~ quartz crystal tuning fork resonator comprising a quartz crystal tuning fork base, first and second quartz crystal tuning fork tines connected to the quartz crystal tuning fork base and each having a first main surface and a second main surface opposite

the first main surface, a groove having a plurality of stepped portions formed in at least one of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines, and an electrode disposed in the groove formed in at least one of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a merit value $M_1$ of a fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than a merit value $M_2$ of a second overtone mode of vibration thereof, the merit values $M_1$ and $M_2$ being defined by the ratios $Q_1/r_1$ and $Q_2/r_2$, respectively, where $Q_1$ and $Q_2$ represent a quality factor of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator and $r_1$ and $r_2$ represent a capacitance ratio of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator; a case for housing the quartz crystal tuning fork resonator; and a lid for covering an open end of the case; ~~quartz crystal tuning fork resonator comprising tuning fork tines and a tuning fork base, to which said tuning fork tines are attached, wherein a groove is provided formed on both of an obverse face and a reverse face of said tuning fork tines, and a first electrode is disposed inside said groove and a second electrode is disposed on both sides of said tuning fork~~

~~tines, and~~ wherein a piezoelectric constant $e_{12}$ of ~~said~~ the quartz crystal tuning fork resonator is within a range of 0.095 $C/m^2$ to 0.19 $C/m^2$ in the absolute value.

5. (currently amended) ~~The~~ A quartz crystal unit according to ~~claim 4, wherein~~ claim 4; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a width of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 0.03 mm to 0.12 mm; wherein a spaced-apart distance between the first and second quartz crystal tuning fork tines is within a range of 0.05 mm to 0.35 mm and greater than or equal to the width of at least one of the grooves; and wherein a length of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 40% to 80% of a length of each of the first and second quartz crystal tuning fork tines. ~~figure of merit~~ ~~$M_1$ for a fundamental mode vibration of said resonator is larger than figure of merit $M_2$ for a second overtone mode vibration thereof.~~

6. (currently amended) ~~The~~ A quartz crystal unit according to ~~claim 5, wherein~~ claim 4; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; and wherein an electrode is disposed in the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a capacitance ratio $r_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is less than a capacitance ratio $r_2$ of the second overtone mode of vibration thereof. ~~figure of merit $M_F$ for the fundamental mode vibration is larger than 65, and figure of merit $M_2$ for the second overtone mode vibration is less than 30.~~

7. (currently amended) ~~The~~ A quartz crystal unit according to ~~claim 5, wherein~~ claim 4; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a width $W_2$ of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 0.03 mm to 0.12 mm; wherein the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines has an inner stepped portion and an outer stepped

portion opposite to the inner stepped portion in the width direction of the corresponding one of the first and second quartz crystal tuning fork tines; wherein each of the first and second quartz crystal tuning fork tines has side surfaces comprising an inner side surface and an outer side surface opposite to the inner side surface, the inner stepped portion being opposite to the inner side surface, and the outer stepped portion being opposite to the outer side surface; and further comprising a first electrode disposed on each of the inner and outer stepped portions of the groove formed in each of the first and second main surfaces of the first and second quartz crystal tuning fork tines and a second electrode disposed on each of the inner and outer side surfaces of the first and second quartz crystal tuning fork tines; wherein the first electrodes disposed on the inner and outer stepped portions of the grooves of the first quartz crystal tuning fork tine are connected to the second electrodes disposed on the inner and outer side surfaces of the second quartz crystal tuning fork tine so that the first electrodes of the first quartz crystal tuning fork tine and the second electrodes of the second quartz crystal tuning fork tine define a first electrode terminal; and wherein the second electrodes disposed on the inner and outer side surfaces of the first quartz crystal tuning fork tine are connected to the first electrodes disposed on the inner and outer stepped portions of the

grooves of the second quartz crystal tuning fork tine so that the second electrodes of the first quartz crystal tuning fork tine and the first electrodes of the second quartz crystal tuning fork tine define a second electrode terminal. ~~a ratio ($W_Z/W$) of a groove width $W_Z$ and a tine width W of said tuning fork tines is greater than 0.35 and less than 1, and a ratio ($t_I/t$) of a groove thickness $t_I$ and a tine thickness t of said tuning fork tines is less than 0.79.~~

8. (currently amended) ~~The~~ A quartz crystal unit according to ~~claim 5, wherein~~ claim 4; wherein a spaced-apart distance between the first and second quartz crystal tuning fork tines is within a range of 0.05 mm to 0.35 mm; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that the spaced-apart distance between the first and second quartz crystal tuning fork tines is greater than or equal to a width of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; wherein the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines has a base portion; and wherein an electrode is disposed on the base portion of the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines

so that the electrodes disposed on the base portions of the grooves of the first quartz crystal tuning fork tine have an electrical polarity opposite to an electrical polarity of the electrodes disposed on the base portions of the grooves of the second quartz crystal tuning fork tine. ~~a groove area S of said tuning fork tines is within a range of 0.025 mm$^2$ to 0.12 mm$^2$.~~

9. (currently amended) ~~The~~ A quartz crystal unit according to ~~claim 5, wherein~~ claim 4; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; wherein the quartz crystal tuning fork base has a cut portion; and wherein a length of the quartz crystal tuning fork base is less than 0.5 mm. ~~a ratio ($l_1/l$) of a groove length $l_1$ and a total length $l$ of said resonator is within a range of 0.2 to 0.78.~~

10. (currently amended) ~~The~~ A quartz crystal unit according to ~~claim 5, wherein~~ claim 4; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; wherein stable factors $S_1$ and $S_2$ of the fundamental mode of vibration and the second overtone mode of vibration of the quartz crystal tuning fork resonator are defined by $S_1=r_1/2Q_1^2$ and $S_2=r_2/2Q_2^2$, respectively;

and wherein an electrode is disposed on the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that $S_1$ is less than $S_2$. ~~when stable factors of frequency, $S_1$ and $S_2$ of the fundamental mode vibration and the second overtone mode vibration of said quartz crystal tuning fork resonator are given by $S_1=r_1/2Q_1^2$ and $S_2=r_2/2Q_2^2$, respectively, $S_1$ is less than $S_2$.~~

11. (currently amended) A quartz crystal oscillator comprising: a quartz crystal oscillating circuit comprised of an ~~comprising; an~~ amplification circuit comprising a CMOS inverter and a feedback resistor, and a feedback circuit comprising a ~~flexural mode, quartz~~ quartz crystal tuning fork ~~resonator,~~ resonator capable of vibrating in a flexural mode of an inverse phase, a plurality of capacitors and a drain resistor, ~~said~~ the quartz crystal tuning fork resonator comprising a quartz crystal tuning fork base, first and quartz crystal tuning fork tines connected to the quartz crystal tuning fork base and each having a first main surface and a second main surface opposite the first main surface, a groove having a plurality of stepped portions formed in at least one of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines, and an electrode being disposed in the groove formed in at least one of the first and second main surfaces of each of the first and second

quartz crystal tuning fork tines so that a merit value $M_1$ of a fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than a merit value $M_2$ of a second overtone mode of vibration thereof, the merit values $M_1$ and $M_2$ being defined by the ratios $Q_1/r_1$ and $Q_2/r_2$, respectively, where $Q_1$ and $Q_2$ represent a quality factor of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator and $r_1$ and $r_2$ represent a capacitance ratio of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator; ~~tuning fork tines and a tuning fork base, to which said tuning fork tines are attached, wherein a groove is provided on both of an obverse face and a reverse face of said tuning fork tines, and~~ wherein a piezoelectric constant $e_{12}$ of ~~said~~ the quartz crystal tuning fork resonator is within a range of 0.095 C/m$^2$ to 0.19 C/m$^2$ in the absolute value.

12. (currently amended) ~~The~~ A quartz crystal oscillator according to ~~claim 11, wherein~~ claim 11; wherein at least one groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a ratio $W_2/W$ is greater than 0.35 and less than 1, where $W_2$ represents a width of at least one of the grooves formed in the first and second main surfaces of each of the first and

second quartz crystal tuning fork tines and W represents a width of each of the quartz crystal tuning fork tines; and wherein a length of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 40% to 80% of a length of each of the first and second quartz crystal tuning fork tines. ~~said quartz crystal oscillating circuit comprises said quartz crystal tuning fork resonator having figure of merit $M_1$ for a fundamental mode vibration larger than figure of merit $M_2$ for a second overtone mode vibration to suppress the second overtone mode vibration and to get a high frequency stability for the fundamental mode vibration.~~

13. (currently amended) ~~The~~ A quartz crystal oscillator according to ~~claim 12, wherein~~ claim 11; wherein a ratio of an amplification rate $\alpha_1$ of the fundamental mode of vibration and an amplification rate $\alpha_2$ of the second overtone mode of vibration of the amplification circuit is greater than that of a feedback rate $\beta_2$ of the second overtone mode of vibration and a feedback rate $\beta_1$ of the fundamental mode of vibration of the feedback circuit, and ~~a ratio($\alpha_1/\alpha_2$) of said oscillating circuit is greater than a ratio($\beta_2/\beta_1$) thereof, and~~ a product of the amplification rate $\alpha_1$ and the feedback rate $\beta_1$ of the fundamental mode of vibration is greater ~~than 1.~~ than 1; wherein a groove having a plurality of stepped portions is formed in each of the first and second main

surfaces of each of the first and second quartz crystal tuning fork tines; and wherein an electrode is disposed in the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a series resistance $R_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is less than a series resistance $R_2$ of the second overtone mode of vibration thereof.

14. (currently amended) ~~The~~ A quartz crystal oscillator according to ~~claim 12, wherein~~ claim 11; wherein a ratio of an absolute value of negative resistance $-RL_1$ of the fundamental mode of vibration of the amplification circuit and a series resistance $R_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than that of an absolute value of negative resistance $-RL_2$ of the second overtone mode of vibration of the amplification circuit and a series resistance $R_2$ of the second overtone mode of vibration thereof; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; and wherein an electrode is disposed in the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a capacitance ratio $r_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is less

than a capacitance ratio $r_2$ of the second overtone mode of vibration thereof. ~~a ratio($|-RL_1|/R_1$) of said oscillating circuit is greater than a ratio($|-RL_2|/R_2$) thereof.~~

15. (currently amended) ~~The~~ A quartz crystal oscillator according to ~~claim 12, wherein~~ claim 11; wherein $|-RL_1|/R_1$ is greater than $2|-RL_2|/R_2 -1$, where $|-RL_1|$ and $|-RL_2|$ represent an absolute value of negative resistance of the fundamental mode of vibration and the second mode of vibration of the amplification circuit, and $R_1$ and $R_2$ represent a series resistance of the fundamental mode of vibration and the second overtone mode of vibration of the quartz crystal tuning fork resonator. ~~a value of ($|-RL_1|/R_1$) of said oscillating circuit is greater than a value of ($2|-RL_2|/R_2-1$) in said oscillating circuit.~~

16. (currently amended) ~~The~~ A quartz crystal oscillator according to ~~claim 12, wherein~~ claim 11; wherein a groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; wherein an electrode is disposed in the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a capacitance ratio $r_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is less than a capacitance ratio $r_2$ of

the second overtone mode of vibration thereof; and wherein the quartz crystal oscillating circuit outputs through a buffer circuit an output signal an oscillation frequency of about 32.768 kHz with a frequency deviation within the range of -100 PPM to +100 PPM. ~~an output signal of said quartz crystal oscillating circuit is outputted through a buffer circuit, and an oscillation frequency deviation of the output signal is within a range of -100 PPM to +100 PPM to a nominal frequency of 32.768 kHz.~~

17. (currently amended) ~~An~~ In an electronic apparatus ~~comprising~~ having a display portion: ~~and a~~ at least one quartz crystal oscillator ~~at least, said electronic apparatus having at least one quartz crystal oscillator, one of the at least one quartz crystal oscillator comprising: a~~ comprising a quartz crystal oscillating circuit ~~comprising; an~~ comprised of an amplification circuit having at least ~~comprising~~ an amplifier, and ~~a feedback resistor, and~~ a feedback circuit comprising at least a quartz crystal tuning fork ~~resonator,~~ resonator capable of vibrating in a flexural mode of an inverse phase, the ~~capacitors and a drain resistor, said quartz crystal resonator being a flexural mode, quartz crystal tuning fork resonator, said~~ quartz crystal tuning fork resonator comprising a quartz crystal tuning fork base, first and second quartz crystal tuning fork tines connected to the quartz crystal tuning fork base and each having a first main

surface and a second main surface opposite the first main surface, a groove having a plurality of stepped portions formed in at least one of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines, and an electrode disposed in the groove formed in at least one of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a merit value $M_1$ of a fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than a merit value $M_2$ of a second overtone mode of vibration thereof, the merit values $M_1$ and $M_2$ being defined by the ratios $Q_1/r_1$ and $Q_2/r_2$, respectively, where $Q_1$ and $Q_2$ represent a quality factor of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator and $r_1$ and $r_2$ represent a capacitance ratio of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator; ~~quartz crystal tuning fork resonator comprising tuning fork tines and a tuning fork base, to which said tuning fork tines are attached, wherein a groove is provided on at least one of an obverse face and a reverse face of said tuning fork tines, and a first electrode is disposed inside said groove and a second electrode is disposed on both sides of said tuning fork tines, and~~ wherein a piezoelectric constant $e_{12}$ of ~~said~~ the quartz crystal tuning fork resonator is within a range of 0.095 $C/m^2$ to 0.19 $C/m^2$ in the absolute value.

18. (currently amended) ~~The~~ An electronic apparatus according to ~~claim 17, wherein~~ claim 17; wherein at least one groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; wherein each of the fundamental mode of vibration and the second overtone mode of vibration of the quartz crystal tuning fork resonator is driven by the piezoelectric constant $e_{12}$ within the range of 0.095 $C/m^2$ to 0.19 $C/m^2$ in the absolute value; wherein $|-RL_1|/R_1$ is greater than $2|-RL_2|/R_2 - 1$, where $|-RL_1|$ and $|-RL_2|$ represent an absolute value of negative resistance of the fundamental mode of vibration and the second overtone mode of vibration of the amplification circuit, and $R_1$ and $R_2$ represent a series resistance of the fundamental mode of vibration and the second overtone mode of vibration of the quartz crystal tuning fork resonator; and wherein an output signal of the quartz crystal oscillating circuit is a clock signal for use in operation of the electronic apparatus to display time information at the display portion, the clock signal having an oscillation frequency of the fundamental mode of vibration. ~~a ratio ($|-RL_1|/R_1$) of said oscillating circuit is greater than a ratio($|-RL_2|/R_2$) thereof, and said quartz crystal oscillating circuit comprises said quartz crystal tuning fork resonator having figure of merit $M_1$ of a fundamental mode vibration larger than figure of merit $M_2$ of a~~

~~second overtone mode vibration to suppress the second overtone mode vibration and to get a high frequency stability for the fundamental mode vibration.~~

19. (currently amended) ~~The~~ An electronic apparatus according to ~~claim 18, wherein~~ claim 17; wherein at least one groove having a plurality of stepped portions is formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; wherein each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines has a central linear portion; wherein the at least one groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is formed in the central linear portion of each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a width of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is greater than a distance in the width direction of the at least one groove measured from an outer edge of the at least one groove to an outer edge of the corresponding one of the first and second quartz crystal tuning fork tines; wherein a length of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 40% to 80% of a length

<u>of each of the first and second quartz crystal tuning fork tines; and wherein an output signal of the quartz crystal oscillating circuit is a clock signal for use in operation of the electronic apparatus to display time information at the display portion, the clock signal having an oscillation frequency of the fundamental mode of vibration.</u> ~~an output signal of said quartz crystal oscillating circuit has an oscillation frequency of the fundamental mode vibration of said flexural mode, quartz crystal tuning fork resonator, and said output signal is a clock signal which is used to display time at said display portion of said electronic apparatus.~~

20. (currently amended) ~~The~~ <u>An</u> electronic apparatus according to ~~claim 19, wherein~~ <u>claim 18; wherein the amplification circuit of the quartz crystal oscillating circuit has a CMOS inverter and a feedback resistor, the feedback resistor having the quartz crystal tuning fork resonator, a plurality of capacitors and a drain resistor, the quartz crystal tuning fork resonator being electrically connected to the amplification circuit and to the plurality of capacitors and the drain resistor of the feedback circuit; wherein the at least one quartz crystal oscillator comprises a quartz crystal oscillating circuit comprising a quartz crystal resonator, an amplifier, a plurality of resistors, and a plurality of capacitors, a mode of vibration of the quartz crystal resonator of the quartz crystal oscillating circuit</u>

being different from that of the quartz crystal tuning fork resonator; and wherein the quartz crystal resonator of the quartz crystal oscillating circuits comprises ~~a quartz crystal unit has~~ one of a length-extensional mode quartz crystal resonator, a thickness shear mode quartz crystal resonator, a width-extensional mode quartz crystal resonator, a Lame mode quartz crystal resonator and a SAW resonator. ~~and at least one quartz crystal oscillator comprises a quartz crystal oscillating circuit comprising said quartz crystal unit.~~

21. (currently amended) ~~The~~ An electronic apparatus according to ~~claim 19, wherein~~ claim 17; wherein the at least one quartz crystal oscillator ~~comprises: a~~ comprises a quartz crystal oscillating circuit ~~comprising; an~~ comprised of an amplification circuit ~~comprising~~ having an amplifier and a feedback resistor, and a feedback circuit comprising a quartz crystal resonator, a plurality of capacitors and a drain resistor, ~~said~~ the quartz crystal resonator being a length-extensional mode quartz crystal ~~resonator, and said length-extensional mode resonator comprising: a~~ resonator comprised of a vibrational portion having a length greater than a width and a thickness smaller than the ~~width; connecting~~ width, connecting portions located at ends of ~~said vibrational portion; supporting~~ the vibrational portion, supporting portions connected to ~~said~~ the vibrational portion through

~~said~~ the connecting ~~portions; electrodes~~ portions, and electrodes disposed opposite each other on upper and lower faces of ~~said~~ the vibrational ~~portion, a~~ portion; wherein a piezoelectric constant $e_{12}$ of ~~said~~ the length-extensional mode resonator ~~being~~ is within a range of 0.095 $C/m^2$ to 0.19 $C/m^2$ in the absolute ~~value, an~~ value; and wherein the ~~output signal of said~~ quartz crystal oscillating circuit ~~comprising said length-extensional mode resonator being outputted~~ outputs a signal through a buffer circuit, ~~and said~~ the output signal being a clock signal ~~which is used except time display~~ for use in operation of ~~said~~ the electronic apparatus.

22. - 23. (canceled).

24. (new) A quartz crystal unit according to claim 4; wherein the quartz crystal tuning fork base has a cut portion; and wherein the quartz crystal tuning fork resonator has a frame portion protruding from the cut portion of the quartz crystal tuning fork base and mounted on a mounting portion of the case.

25. (new) A method for manufacturing an electronic apparatus, comprising the steps of:

providing a display portion;

forming at least one quartz crystal tuning fork resonator capable of vibrating in a flexural mode of an inverse phase and having a fundamental mode of vibration, a

second overtone mode of vibration, a quartz crystal tuning fork base, and first and second quartz crystal tuning fork tines connected to the quartz crystal tuning fork base and each having side surfaces;

disposing an electrode on each of two of the side surfaces of each of the first and second quartz crystal tuning fork tines so that the electrodes disposed on the side surfaces of the first quartz crystal tuning fork tine have an electrical polarity opposite to an electrical polarity of the electrodes disposed on the side surfaces of the second quartz crystal tuning fork tine;

providing at least one quartz crystal oscillator comprising a quartz crystal oscillating circuit comprised of an amplification circuit having a CMOS inverter and a feedback resistor, and a feedback circuit having the quartz crystal tuning fork resonator;

mounting the quartz crystal tuning fork resonator on a mounting portion of a case using a conductive adhesive or solder; and

adjusting an oscillation frequency of the quartz crystal tuning fork resonator so that the quartz crystal oscillating circuit outputs an output signal of the oscillation frequency of about 32.768 kHz with a frequency deviation within a range of -100 PPM to +100 PPM;

wherein a ratio of an absolute value of negative resistance $-RL_1$ of the fundamental mode of vibration of the amplification circuit and a series resistance $R_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than a ratio of an absolute value of negative resistance $-RL_2$ of the second overtone mode of vibration of the amplification circuit and a series resistance $R_2$ of the second overtone mode of vibration thereof;

wherein a merit value $M_1$ of the fundamental mode of vibration of the quartz crystal tuning fork resonator is greater than a merit value $M_2$ of the second overtone mode of vibration thereof, the merit values $M_1$ and $M_2$ being defined by the ratios $Q_1/r_1$ and $Q_2/r_2$, respectively, where $Q_1$ and $Q_2$ represent a quality factor of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator and $r_1$ and $r_2$ represent a capacitance ratio of the fundamental mode of vibration and the second overtone mode of vibration, respectively, of the quartz crystal tuning fork resonator; and

wherein a piezoelectric constant $e_{12}$ of the quartz crystal tuning fork resonator is within a range of 0.095 $C/m^2$ to 0.19 $C/m^2$ in the absolute value.

26. (new) A method according to claim 25; wherein the forming step includes the steps of forming a plurality of the quartz crystal tuning fork resonators in a quartz crystal

wafer, inspecting the quartz crystal wafer to identify any damaged quartz crystal tuning fork resonators, and either marking the damaged quartz crystal tuning fork resonators in the quartz crystal wafer, storing in a computer identification information corresponding to the damaged quartz crystal tuning fork resonators, or removing from the quartz crystal wafer the damaged quartz crystal tuning fork resonators.

27. (new) A method according to claim 25; further comprising the step of electrically connecting the quartz crystal tuning fork resonator to the amplification circuit; and wherein an output signal of the quartz crystal oscillating circuit comprises a clock signal for use in operation of the electronic apparatus to display time information at the display portion, the clock signal having an oscillation frequency of the fundamental mode of vibration of the quartz crystal tuning fork resonator.

28. (new) A method according to claim 27; wherein the quartz crystal oscillating circuit comprises a quartz crystal resonator, an amplifier, a plurality of resistors, and a plurality of capacitors, the quartz crystal resonator comprising one of a length-extensional mode quartz crystal resonator, a thickness shear mode quartz crystal resonator, a width-extensional mode quartz crystal resonator, a Lame mode quartz crystal resonator, and a SAW resonator; wherein a mode

of vibration of the quartz crystal resonator is different from that of the quartz crystal tuning fork resonator capable of vibrating in a flexural mode; and wherein an output signal of the quartz crystal oscillating circuit comprises a clock signal for use in operation of the electronic apparatus.

29. (new) A method according to claim 25; wherein each of the first and second quartz crystal tuning fork tines has first and second opposite main surfaces and first and second opposite side surfaces; wherein the forming step further comprises the step of forming a groove having a plurality of stepped portions in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; wherein the disposing step comprises the steps of disposing a first electrode on each of at least two of the stepped portions of the groove in each of the first and second main surfaces of the first and second quartz crystal tuning fork tines and a second electrode on each of the first and second side surfaces of each of the first and second quartz crystal tuning fork tines; and wherein an output signal of the quartz crystal oscillating circuit comprises a clock signal for use in operation of the electronic apparatus to display time information at the display portion, the clock signal having an oscillation frequency of the fundamental mode of vibration of the quartz crystal tuning fork resonator.

30. (new) A method according to claim 29; wherein the forming step comprises the steps of forming the first and second quartz crystal tuning fork tines in a first etching process; and forming at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines in a second etching process different from the first etching process, the step of forming the first and second quartz crystal tuning fork tines being performed before the step of forming the at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; and further comprising the steps of connecting the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the first quartz crystal tuning fork tine to the second electrodes disposed on the first and second side surfaces of the second quartz crystal tuning fork tine to form a first electrode terminal, and connecting the second electrodes disposed on the first and second side surfaces of the first quartz crystal tuning fork tine to the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the second quartz crystal tuning fork tine to form a second electrode terminal.

31. (new) A method according to claim 29; wherein the forming step comprises the steps of forming the first and second quartz crystal tuning fork tines in a first etching process; and forming at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines in a second etching process different from the first etching process, the step of forming the first and second quartz crystal tuning fork tines being performed after the step of forming the at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; and further comprising the steps of connecting the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the first quartz crystal tuning fork tine to the second electrodes disposed on the first and second side surfaces of the second quartz crystal tuning fork tine to form a first electrode terminal, and connecting the second electrodes disposed on the first and second side surfaces of the first quartz crystal tuning fork tine to the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the second quartz crystal tuning fork tine to form a second electrode terminal.

32. (new) A method according to claim 29; wherein the forming step comprises the steps of forming the first and second quartz crystal tuning fork tines in a first etching process so that a spaced-apart distance between the first and second quartz crystal tuning fork tines is within a range of 0.05 mm to 0.35 mm; and forming at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines in a second etching process different from the first etching process so that a width $W_2$ of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 0.03 mm to 0.12 mm and a ratio $W_2/W$ is greater than 0.35 and less than 1, where W represents a width of each of the quartz crystal tuning fork tines, the spaced-apart distance between the first and second quartz crystal tuning fork tines being greater than or equal to the width $W_2$ of the at least one groove, and the step of forming the first and second quartz crystal tuning fork tines being performed before the step of forming the at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines.

33. (new) A method according to claim 29; wherein the forming step comprises the steps of forming the first and second quartz crystal tuning fork tines in a first etching

process so that a spaced-apart distance between the first and second quartz crystal tuning fork tines is within a range of 0.05 mm to 0.35 mm; and forming at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines in a second etching process different from the first etching process so that a width $W_2$ of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 0.03 mm to 0.12 mm and a ratio $W_2/W$ is greater than 0.35 and less than 1, where W represents a width of each of the quartz crystal tuning fork tines, the spaced-apart distance between the first and second quartz crystal tuning fork tines being greater than or equal to the width $W_2$ of the at least one groove, and the step of forming the first and second quartz crystal tuning fork tines being performed after the step of forming the at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines.

34. (new) A method according to claim 29; wherein each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines has a central linear portion; wherein the groove formed in each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is formed in the

central linear portion of each of the first and second main surfaces of each of the first and second quartz crystal tuning fork tines so that a width of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is greater than a distance in the width direction of the at least one groove measured from an outer edge of the at least one groove to an outer edge of the corresponding one of the first and second quartz crystal tuning fork tines; wherein the forming step comprises the steps of forming the first and second quartz crystal tuning fork tines in a first etching process, and forming at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines in a second etching process, the step of forming the first and second quartz crystal tuning fork tines being performed simultaneously with the step of forming the at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines; and further comprising the steps of connecting the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the first quartz crystal tuning fork tine to the second electrodes disposed on the first and second side surfaces of the second quartz crystal tuning fork tine to form a first electrode terminal, and

connecting the second electrodes disposed on the first and second side surfaces of the first quartz crystal tuning fork tine to the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the second quartz crystal tuning fork tine to form a second electrode terminal.

35. (new) A method according to claim 29; wherein the forming step comprises the steps of forming the first and second quartz crystal tuning fork tines in a first etching process so that a spaced-apart distance between the first and second quartz crystal tuning fork tines is within a range of 0.05 mm to 0.35 mm, and forming at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines in a second etching process so that a width $W_2$ of at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines is within a range of 0.03 mm to 0.12 mm and a ratio $W_2/W$ is greater than 0.35 and less than 1, where W represents a width of each of the quartz crystal tuning fork tines, the spaced-apart distance between the first and second quartz crystal tuning fork tines being greater than or equal to the width $W_2$ of the at least one groove, and the step of forming the first and second quartz crystal tuning fork tines being performed simultaneously with the step of forming the at least one of

the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines.

36. (new) A method according to claim 39; wherein the quartz crystal tuning fork base has a cut portion; wherein the forming step comprises the steps of forming the first and second quartz crystal tuning fork tines and the quartz crystal tuning fork base having the cut portion in a first etching process; and forming at least one of the grooves formed in the first and second main surfaces of each of the first and second quartz crystal tuning fork tines in a second etching process different from the first etching process; and further comprising the steps of connecting the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the first quartz crystal tuning fork tine to the second electrodes disposed on the first and second side surfaces of the second quartz crystal tuning fork tine to form a first electrode terminal; and connecting the second electrodes disposed on the first and second side surfaces of the first quartz crystal tuning fork tine to the first electrodes disposed on at least two of the stepped portions of the groove formed in each of the first and second main surfaces of the second quartz crystal tuning fork tine to form a second electrode terminal.

37. (new) A method according to claim 30; further comprising the step of electrically connecting the quartz crystal tuning fork resonator to the amplification circuit and to the capacitors and the drain resistor of the feedback circuit; wherein the at least one quartz crystal oscillator comprises a quartz crystal oscillating circuit comprising a quartz crystal resonator, an amplifier, a plurality of resistors, and a plurality of capacitors, the quartz crystal resonator comprising one of a length-extensional mode quartz crystal resonator, a thickness shear mode quartz crystal resonator, a width-extensional mode quartz crystal resonator, a Lame mode quartz crystal resonator and a SAW resonator, and a mode of vibration of the quartz crystal resonator of the quartz crystal oscillating circuit being different from that of the quartz crystal tuning fork resonator; and wherein an output signal of the quartz crystal oscillating circuit comprises a clock signal for use in operation of the electronic apparatus.